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Additions to the smut fungi of Pakistan. 2

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Abstract — Two species of smut fungi, *Sporisorium lingii* on *Themeda anathera* and *Urocystis oryzopsidis* on *Piptatherum microcarpum,* are reported for the first time from Pakistan. Both smut fungi were found on new host plants. *Chrysopogon serrulatus* is recorded from Pakistan as a new host of *Anthracocystis chrysopogonis.*

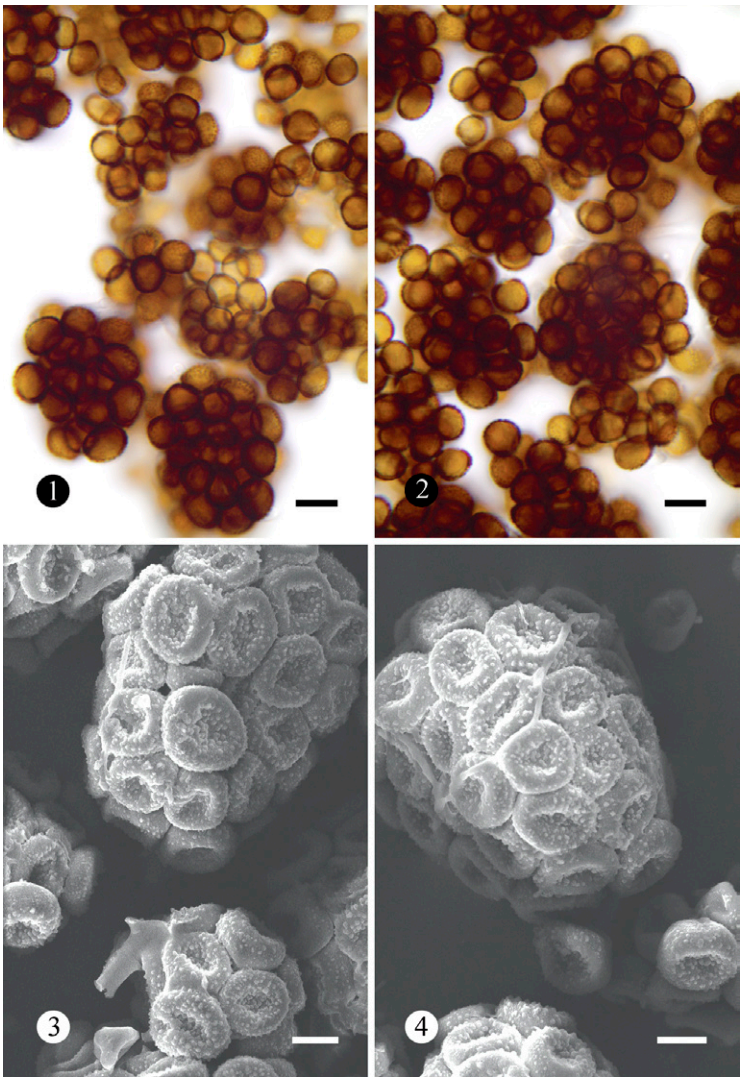
Key words — *Poaceae,* taxonomy, *Ustilaginomycetes*

Introduction

Three smut fungi of poaceous hosts are described in this third contribution to the smut fungi of Pakistan based on material collected by M. Fiaz in 2009–10, in Mansehra District (Khyber Pakhtunkhwa Province) (Denchev et al. 2012, Fiaz et al. 2013). Two species, both on new hosts, *Sporisorium lingii* on *Themeda anathera* and *Urocystis oryzopsidis* on *Piptatherum microcarpum,* are reported for the first time from Pakistan. *Anthracocystis chrysopogonis* is recorded on a new host, *Chrysopogon serrulatus.*

Material & methods

Dried specimens from the Hazara University Herbarium (HUP), Pakistan were examined under light (LM) and scanning electron (SEM) microscopes. For LM observations, spores were mounted in lactophenol solution on glass slides, gently heated to boiling point to rehydrate the spores, and then cooled. Spore measurements are given in the form: min–max (mean ± 1 standard deviation). For SEM, spores were attached to specimen holders by double-sided adhesive tape and coated with gold with an ion sputter. The surface structure of spores was observed at 10 kV and photographed with a JEOL SM-6390 scanning electron microscope.



Figs 1–4. *Anthracocystis chrysopogonis* on *Chrysopogon serrulatus* (HUP 307). Spores in LM and SEM. Scale bars: 1, 2 = 10 µm; 3, 4 = 5 µm.

Taxonomy

Anthracocystis chrysopogonis (Vánky) McTaggart & R.G. Shivas, Persoonia 29: 120, 2012. Figs 1–4

≡ *Sporisorium chrysopogonis* Vánky, Mycotaxon 18: 327, 1983.

Sori destroying the whole inflorescence, partly hidden by the leaf sheath, up to 22 mm in length and 2 mm in width; initially covered by an yellowish brown

peridium which later ruptures from its apex exposing semi-agglutinated, dark reddish brown mass of spore balls and numerous filiform columellae. Spore balls subglobose, broadly ellipsoidal, ovoid or slightly irregular, 23–66 × 20–45 µm, dark to middle reddish brown, composed of 8 to tens of spores that separate by pressure. Single sterile cells very rarely present; subglobose, broadly ellipsoidal, slightly irregular, sometimes collapsed, 8.5–13 × 8–12 µm, hyaline; wall 1.2–2 µm thick, smooth. Spores dimorphic, globose, subglobose, broadly ellipsoidal, ovoid or slightly irregular. Outer spores 8–12(–13) × 7–10 (10.0 ± 0.9 × 8.4 ± 0.6) µm (n = 50), middle reddish brown; wall uneven, 0.7–1.3 µm thick, smooth on the contact surface, verruculose-echinulate on the free surface, spore profile slightly affected. In SEM verruculose-echinulate, finely punctate between the main ornaments. Inner spores (7–)7.5–11 × 6.5–9 (8.6 ± 0.8 × 7.6 ± 0.5) µm (n = 50), light yellowish brown; wall evenly thickened, 0.4–0.7 µm thick, smooth to very finely punctate.

Specimen examined — On *Chrysopogon serrulatus* Trin.: **PAKISTAN, Khyber Pakhtunkhwa Province,** Mansehra District, Chulandrian (Oghi), August 2010, leg. M. Fiaz, no. FS–23 (HUP 307).

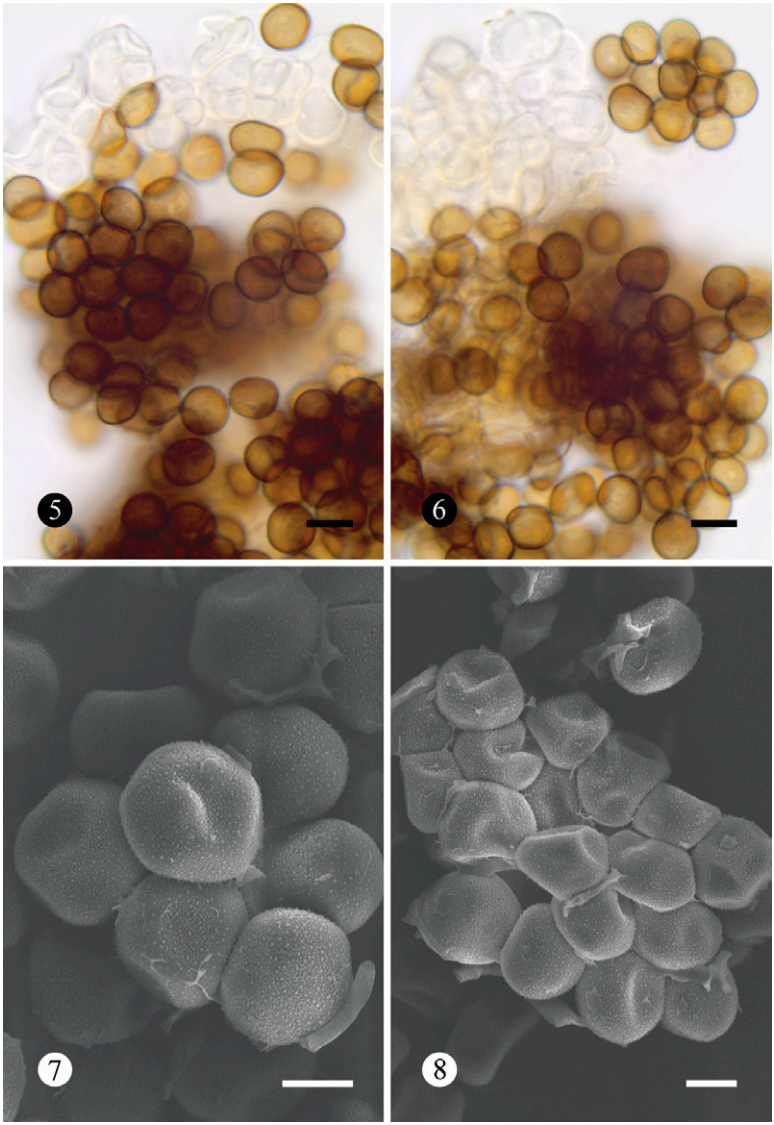
Distribution — This species has been previously known on *Chrysopogon fulvus* (Spreng.) Chiov. (= *C. montanus* Trin.) and *Chrysopogon* sp. from Sri Lanka and Pakistan (Vánky 2005, 2011). *Chrysopogon serrulatus* is a new host record for this smut fungus.

Comments — The spore balls of this specimen are a little more loose compared with those of the isotype (on *Chrysopogon fulvus,* Sri Lanka, North Central Province, Polonnaruwa Distr., Habarane, alt. 250 m, 18 March 1974, K. Vánky, in Vánky, Ustilag. exs., no. 407, SOMF), studied by us.

Sporisorium lingii Vánky, Mycotaxon 51: 160, 1994. Figs 5–8

Sori in all of the spikelets of the raceme, all racemes of an inflorescence affected, 5–12 × 1–2 mm, cylindrical, initially covered by an yellowish brown peridium that soon flakes away exposing a single, branched columella, surrounded by a dark brown mass of readily disintegrating spore balls, spores, and sterile cells. Spore balls loose, middle to dark reddish brown, composed of tens to hundreds of spores. Sterile cells in irregular groups, subglobose to irregular, often collapsed, 9–19 × 8.5–18 µm, hyaline to subhyaline; wall 0.9–1.9 µm thick, smooth. Spores globose, subglobose, broadly ellipsoidal or slightly irregular, 8.5–12.5 × 7.5–11 (10.3 ± 0.7 × 9.3 ± 0.6) µm (n = 100), middle reddish brown; wall evenly thickened, 0.6–0.9 µm thick, smooth to very finely punctate. In SEM very finely echinulate, densely punctate between the spinules.

Specimen examined — On *Themeda anathera* (Nees ex Steud.) Hack.: **PAKISTAN, Khyber Pakhtunkhwa Province,** Mansehra District, Oghi, Khabbal Paien, August 2010, leg. M. Fiaz, no. FS–21 (HUP 309).



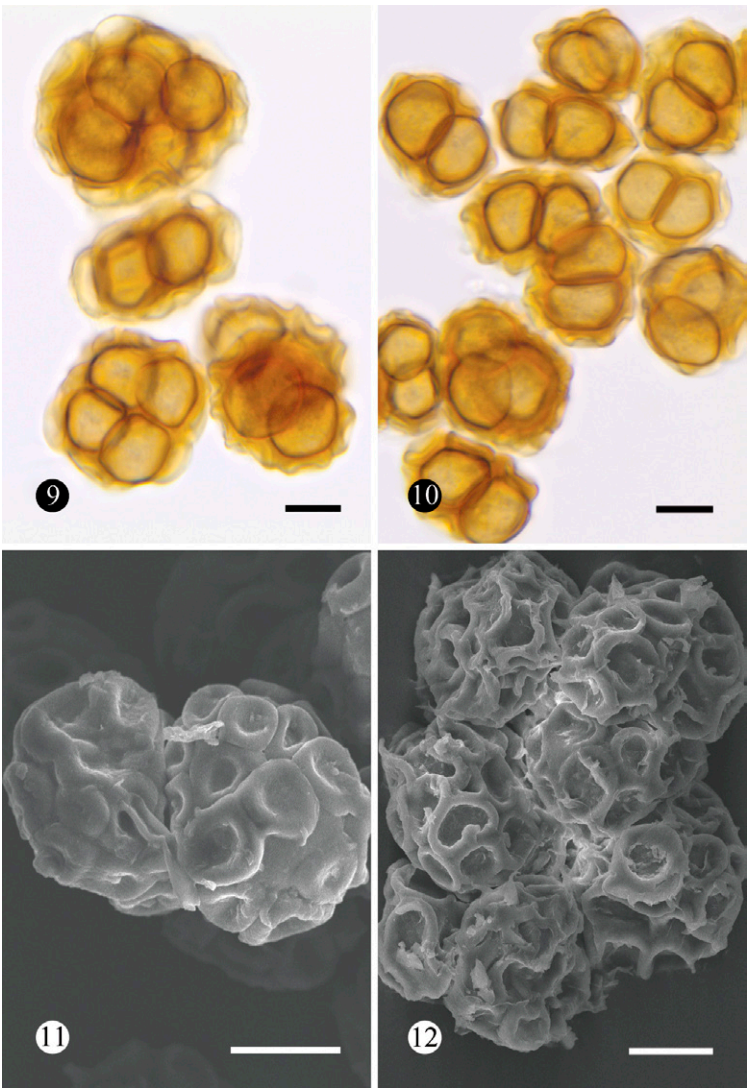
Figs 5–8. *Sporisorium lingii* on *Themeda anathera* (HUP 309).
Spores and sterile cells in LM and SEM. Scale bars: 5, 6 = 10 µm; 7, 8 = 5 µm.

Distribution — This species has been previously known on *Themeda triandra* Forssk. and *Themeda* sp. from S. Asia and Australia (Vánky 2011). *Themeda anathera* is a new host record for this species.

Urocystis oryzopsidis Padwick & Azmatullah, Mycological Papers 10: 1, 1944.

Figs 9–12

Sori in leaves, as long striae between the veins, at first lead-coloured and covered by the epidermis which later ruptures and disclosing the spore balls. Spore balls mass powdery, dark reddish brown. Spore balls subglobose,



Figs 9–12. *Urocystis oryzopsidis* on *Piptatherum microcarpum* (HUP 315). Spore balls in LM and SEM. Scale bars: 9, 10 = 10 µm; 11, 12 = 5 µm.

broadly ellipsoidal, ellipsoidal or irregular, composed of 1–5(–6) central spores [1 = 6.1%, 2 = 27.9%, 3 = 42.3%, 4 = 16.9%, 5 = 5.8%, 6 = 1.0%; n = 409], usually completely invested by a layer of sterile cells; 15–25.5 × 15–20.5 µm [with 1 spore], 17.5–31 × 15.5–20.5 µm [with 2 spores], 21–34.5 × 17–27.5 µm [with 3 spores], 26–39.5 × 18.5–32.5 µm [with 4 spores]. Sterile cells variable in shape, often collapsed, 6–16 µm long, light yellowish brown; wall 0.8–1.5 µm thick, smooth. Spores subglobose, broadly ellipsoidal, ovoid, slightly irregular, sometimes flattened on the contact sides, 10.5–17(–18) × 8–13 (13.7±1.6 × 10.8±1.0) µm (n = 50), medium reddish brown; wall 0.8–1.3 µm thick, smooth.

Specimen examined — On *Piptatherum microcarpum* (Pilg.) Tzvelev (= *P. vicarium* (Grigorj.) Roshev.): **PAKISTAN, Khyber Pakhtunkhwa Province,** Mansehra District, Jaba, 3 September 2009, leg. M. Fiaz, no. FS–12 (HUP 315).

Distribution — This smut fungus has been previously known only from the type locality (India, Kashmir) on *Piptatherum munroi* (Stapf ex Hook. f.) Mez (as *Oryzopsis munroi*).

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